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# THE COST OF PRODUCTION

BY CHARLES J. WATTS

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# THE COST OF PRODUCTION

BY CHARLES J. WATTS

MUSKEGON MICHIGAN CHICAGO

THE SHAW-WALKER COMPANY

*R.H.*

## BY THE SAME AUTHOR

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**SYSTEM IN BUYING.** A purchasing agent's complete organization—the result of several years of experiment and test. Fully illustrated and described in **SYSTEM**. November and December, 1901, and January, 1902. The three numbers, 25 cents.

**EXACT FACTORY COSTS.** With nine illustrations. A minutely accurate method of accounting the cost of each piece or part separately—a balance ledger system. February, March and April, 1902. Three numbers, 25 cents.

**INDEXING AND RECORDING PATTERNS.** With illustrations. A simple and effective plan for the progressive foundryman. Two numbers, November and December, 1901, 20 cents.

## IN PREPARATION

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**SYSTEM IN PUBLISHING.** A complete system for all printers and publishers, covering every item of cost in any kind of typographical work. A circulation plan for daily and weekly newspapers is included. Thirty illustrations.

All descriptions are in short, time-saving paragraphs for the busy man.

In addition to the specific information mentioned, the magazines enumerated above contain useful suggestions along many other lines. Mr. Watts describes systems—the result of his personal experience and observation. Every point is clearly illustrated. Other competent men present in every issue simple systems of practical value.

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# THE COST OF PRODUCTION



## THE COST OF PRODUCTION.

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To devise a simple, effective and economical system for securing accurate factory costs is a problem many manufacturers have yet to solve. In these days of fierce competition, the average maker of a standard line of goods is tempted to use the selling prices of his competitors as a guide in determining his own.

But, he cannot be certain that the result obtained by this means will ensure a profit under the conditions peculiar to his factory. He is at all times confronted with the idea that his competitors may be more progressive and that the systems employed by them may facilitate the operations in their factories and thus reduce the cost of production. With this uncertainty of his competitors' methods and systems he cannot with safety base his cost simply on their selling prices.

Again, the manufacturer who operates his factory on the basis of the cost of material and of flat

labor, adding a percentage to cover non-productive labor, manufacturing expense and general expense, as well as contemplated profits, is no nearer the solution of the problem of factory costs than the one relying simply on the prices charged for similar goods by other concerns.

In these pages is presented a cost system, which, while free from all the intricate problems of a balance-ledger system, furnishes information sufficiently accurate for all practical purposes. It will also enable the progressive manufacturer to determine his own costs absolutely, as well as to point out to his superintendent any weakness existing in the operation of the factory and so provide for a speedy reduction of excessive expense in the cost of manufacture.

This system is a clear and concise statement of what the factory is consuming in labor and in material, as well as of its operating expenses. No profits are included.

As there are but five main accounts to be considered, it is more simple, but at the same time as complete and as effective as many which are more elaborate and complicated.

The terms and illustrations used in describing and explaining the workings of this system are taken from the author's experience in the manufacture of agricultural implements. They are

simply illustrative. To apply the principles to the conditions existing in any factory; it is only necessary to substitute for those used in this book, the terms and units of your own product.

The principal items which contribute to the costs in a factory, are material, labor, manufacturing supplies, special items of cost and general expense.

## MATERIAL.

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Material is the basis of manufacture and in a system of factory costs it should be first considered.

The illustration (Fig. I) represents the cutting list or detail of one part; i. e., a shaft of a hay rake. In the same manner this detail arrangement may be applied to any standard line of goods manufactured in quantities, or to goods made up in advance of specific orders or sales.

The different kinds of materials used are specified under sub-headings, so as to permit of a summary being readily made of the totals required of any particular kind or class of material.

On the guide space of the front of the card is the part number and the name of the given part. Under this guide space is the name of the machine to which the part belongs. Under "Size and Dimensions" are the width, the thickness and the length of the wood used in this part. Next to this is the quantity in feet, hundredths of a foot,



and in the several columns to the right are the numbers of pieces of this kind used on this implement. Following this is the column showing the kind of material used.

Below are spaces for three changes should the thickness, length, kind of stock, or other detail be changed.

The finish of the part or anything special is noted under "Remarks."

On the reverse side of the card is provided a space for recording the cost of labor, which will be referred to later on.

In describing the system, an 8 x 20 tooth rake will be used as an example. Other sizes would of course be computed on the same basis.

To arrive at the cost of material in this

C.1 Shaft R			C.2 Shaft L			C.3 Single Tree			
Metal Frame			Crescent			SD Rake			
SIZE OR DIMENSION			FEET OR WEIGHT	8 x 20	8 x 26	8 x 24	8 x 30	10 x 26	RING OF MATERIAL
3'	2"	1 1/2"	467	1	1	1	1	1	Ash
REMARKS									
Finished in natural wood.									
Striped and one coat varnish.									

FIG. 1 (obverse).

machine, complete, a material summary card, (Fig. II) is used, which gives the totals in feet, pounds or count of the different kinds of material used, made up from the separate detail cards (Fig. I).

In a rake of this kind the materials used are lumber, cast iron, malleable iron, common bar steel, spring steel, rake tooth stock, etc., as well as bolts, nuts, washers, hinge pins, cotters and other small stock.

In making up this detail (Fig. I) there should be a card for each part, bolt, nut, washer, etc., so that there will be a complete list of all the materials in the implement. In case any parts are bought outside of the factory, the detail cards (Fig. I) can be ruled on the back to provide a

C3 Labor		C2 Labor		C1 Labor			
DEPT	Price pr 100	DATE	DATE	DATE	DATE	DATE	DATE
Wood Shop		9-21-06	9-23				
Sawing out	1 25		1 15				
Sawing Paper	50		50				
Chamfering	25		25				
Boring	20		15				
Sanding	15		15				
	2 35		2 20				
Paint Shop							
Striping	50						
Varnish	25						
	75						

FIG. I (reverse).

space for keeping a record of the contract price in place of the labor ruling as shown, or the same labor ruling could be used, substituting the price in place of labor operations.

A total summary (Fig. III) of material and labor, shows the complete cost of 100 machines. To arrive at this result the totals of the different materials, as shown by the material summary cards (Fig. II) are taken, for example, first the item of lumber, \$55.80, was obtained from the card shown in Fig. II. The other items in the summary were obtained in a similar manner.

While the cost of labor is also shown in this summary, the method of computing it will be explained further on.

These summaries are to be made up whenever

Lumber					Cast Iron					Mall Iron				
PCE. NO.	KIND	FEET	PRICE	COST	PCE. NO.	KIND	FEET	PRICE	COST	PCE. NO.	KIND	FEET	PRICE	COST
C1	Ash	467	0.230	6.14	C1	Iron	1078		21.86					
C2	"	467		6.14	C2	Ash	1850		50.94					
C3	Hickory	270	0.240	4.8		Total	2128		55.80					
C4	Ash	150		1.15										
C5	Hickory	125		.58										
C6	Ash	250		1.15										
C7	"	275		1.73										
C8	"	290		2.07										
C9	"	380		1.15										
C10	"	315		.35										
C11	"	210		.23										
C12	Hickory	110		.21										
C13	Ash	150		3.45										
	Forward	3278		21.86										

FIG. II.

a revised cost is wanted, as the cost of manufacture may increase or decrease with changing conditions of the labor or of the material market.

In computing costs according to this system only the actual amounts of material necessary to make the part have been considered and there must, of course, be an allowance for waste.

This the foreman of the wood shop can estimate so that an accurate percentage can be added to the cost of the lumber. In this line of goods, the waste will average 20 per cent., while with castings, steel parts, bolts, nuts, washers, etc., 3 to 5 per cent. will cover any ordinary waste.

As every progressive manufacturer contracts for material on the basis of a season's supply, it is not difficult to determine the cost of the different raw materials.

TOTAL SUMMARY ON*			
MATERIAL	NO LABOR	LABOR	MATERIAL
Lumber			95.80
Gas from			100
Wells from			460
Common steel			3.95
Spring steel			870
Tooth steel			150
Bolts			7.85
Auto Washers			2.15
Miscellaneous			90
Wood shop		16.80	920
Paints shop	32%	5.31	
	10%	7.82	
Machine shop		1.17	
	37 1/2%	8.95	
Steel shop		2.42	
	25 1/4%	12.20	
Assembly Room		4.15	
	30%	15.19	
		15.56	
Foundry		12.30	
	25%	27.1	
		93.65	941.65
40 r30%		37.46	2.84
TOTAL		131.11	9749.2860

It is recommended that the detail cards (Fig. I) be made up on the detail side in the office and that the labor items be recorded on the cards by the clerks in the several departments through which the pieces pass in course of manufacture. They are then to be delivered to the cost department, where the cards (Figs. II and III) are compiled, after which all cards are kept in a cabinet in the cost department.

If any changes occur affecting the kind, cost or quantity, of material, the clerk having charge of such details may either make the changes from time to time as they occur, or preferably by means of a notification slip, advise the cost clerk of these changes. The latter can then record the changes at his leisure. This system permits of a perpetual

Heat 1 to 12

Heat 13 to 25

Heat 26 to 38

CUPOLA RECORD FOR TWO WEEKS ENDING

Sept. 21 - 00

MATERIAL AND LABOR	COST	MEMORANDA	WT & COST
DeBard Iron 5580 @ 10 <sup>00</sup>	558.00	Total Cost	1358.00
Low Moor 41200 @ 10 <sup>00</sup>	412.60	Less Defective	123.00
Richwood 16000 @ 10 <sup>00</sup>	70.50	Total Prod.	1235.00
Graph 23000 @ 8 <sup>00</sup>	81.12		
Coke 136000		Average cost per lb.	0.008
Gate 16500 @ 3 <sup>75</sup>	30.94	Avg. cost to melt per ton	1.00
		Percentage Defective	2.75
Cupola Labor	24.00	Average melt per heat	11335
(From Pay Roll)		Average cost per heat	53.79
Add Non Pro. 22%	5.28	Gate	
		Gate	
Total Cost	639.14		

FIG. IV.

cost account being kept, since there is provision in both cards (Fig. I and II) for recording such changes.

As many manufacturing plants make their own cast iron, they no doubt have a foundry statement showing the cost of melted iron from the cupola. But to make this simple system complete, we submit an easy method (Fig. IV) for obtaining the cost of melted iron. The labor of the molders is recorded on the back of the detail card (Fig. I) so that the material is figured separately from it.

To obtain the cost of one pound of melted iron from the cupola, the total cost of pig iron, scrap, sprues, gates and coke, together with cupola labor, is divided by the total weight of the good castings obtained from the heat. The result will be the cost per pound of melted iron. Castings are figured at the cost of melted iron, and the foundry labor is added afterwards. This gives the actual cost per casting. For malleable iron the same general rule applies.

On this card (Fig. IV) is kept the heat record of the foundry. These cards are filed in a cabinet and form an excellent comparative statement. Although different kinds of pig iron would not be bought at the same price per ton, a fixed amount is here used to simplify the example. It should be charged at cost.

Twenty-two per cent is added to the cupola labor for the non-productive labor, as it represents the per cent which covers the cost of foreman, clerk, rough labor, etc. in the foundry. This is fully explained further on.

The remaining entries on these cards not specifically referred to are self-explanatory, and will suggest for entry other items of information which will prove to be of interest and value not only to the superintendent but to the manager as well.



## LABOR.

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Of equal importance with the cost of the materials used in the process of manufacturing in determining the total cost of production, is labor.

Labor, in manufacturing, is divided into three classes. Productive labor is that which produces something tangible and of asset value. In other words, it is the labor that from raw material makes a finished piece or part.

Next is departmental non-productive labor. This is that class of labor in each department which is necessary to make the productive labor most effective but does not of itself produce anything. To be more explicit, a manufacturing department is generally made up of a number of men over whom is a foreman, and if the number of men be large there is a clerk also. There are also truckers, oilers, and a general class of roustabouts who must be maintained in the department in order that the producers may work to advantage.

In the plant must also be shipping and stock



clerks, timekeepers, engineers and others who belong to no one department but who are a positive necessity in order that the producing departments may operate effectively. The labor of these is called general non-productive labor.

If \$1.00 be the value of productive labor and to it be added 30 per cent as the value of the departmental non-productive labor, \$1.30 results. To this is to be added the general non-productive labor which may be assumed to be 40 per cent of total productive which will give \$1.70 as the real cost of each \$1.00 of productive labor in the department.

If the percentages above referred to are properly calculated, and to the cost of all the productive labor in the factory is added departmental and general non-productive percentages, the result is the exact amount of the pay roll for the term or period considered.

In order properly to handle the cost of labor it is recommended that piece prices be established in all departments which will not only simplify the matter of records, but will also result in a saving in the cost of manufacture, as it is a well known fact that piece workers are prone to produce more work in a given time than day workers, the greater effort of each one being attended by a consequent gain to him in earnings.



to as C 1. As six columns are provided on this card for changes in cost prices it will last a long time.

Since in many manufactured articles certain parts are identical, not so many cards will be required as would at first thought seem necessary. For example, in this case the part C 1 although belonging specifically to one particular rake, is also a part of other rakes and consequently this one card will suffice in making up the costs of all rakes in which this part is used.

The card authorizing these changes (Fig. VI) is to be made out by the foreman of the department and sent to the superintendent for his approval. If the superintendent approves of

CHANGE AND NEW PRICE TAG			
PART NO.	C. 1	DATE	Sept 23-1900
PART NAME	Right Shaft.		
OPERATION	① Sawing out. ② Boring.		
OLD PRICE PER 100	\$ 1.25	NEW PRICE PER 100	\$ 1.15
REASON FOR CHANGE	Too high.		
OLD PRICE PER 100	\$ .20	NEW PRICE PER 100	\$ .15
REASON FOR CHANGE	Change in manufacture.		
COST RECORD CHANGED	Johnson 9/23-1900.		
TIME RECORD CHANGED	Bradley 9/23-1900		
O. R.	Jones.	SUPT.	Green
WOOD SHOP RECORD CHANGED	Green 9/23-1900.		

FIG. VI.

the change, the original and duplicate cards are sent to the cost clerk who signs his name to the original as evidence that the change has been recorded. The original is then sent to the timekeeper for his guidance in making up the pay roll. The duplicate is retained by the cost department and the change is noted on the reverse side of the detail card (Fig. I reverse).

The original card is returned, properly signed by the time keeper, to the foreman of the department by whom the notification card was issued. This now indicates to him that the change has been made in the cost department and the wood shop price card for the part C1 is now corrected (Fig. V). These changes serve to keep the records accurate and show at any time the exact cost of labor in each department. Changes of this kind must of course be attended to promptly, so that each interested person may be advised of them on the same day. The figures in circles represent the numbers of the operations.

In addition to the piece price cabinets in the different departments it is recommended that a large cabinet be kept in the timekeeper's office in which piece prices may be kept by the timekeeper so that the time cards may be checked. This constitutes a check on the different departments and insures the accuracy of the pay roll.

A simple form of time ticket (Fig. VII) is presented which with modifications may be made to answer for all departments. The example given (Fig. VII) is the time card of a man working on on the part C1 in the workshop.

These time cards are intended to be used by every man on the pay roll. The several departments are numbered. One to six may be the producing departments and numbers from seven onward may be applied to the non-productive departments, according to the division desired.

Of course all departments numbered above six are for general non-productive labor except where the labor performed in each pertains to tools, patterns, permanent equipment, machinery, assets or permanent values.

TIME CARD												CHECK NO. 20					
WORKMAN																	
John N. Wilson												Sept. 21, 1900					
Sawing out 100 C. 1.																	
Order @ \$1.25 \$1.25																	
MORNING						AFTERNOON											
START			STOP			START			STOP								
6	10	20	X	40	50	6	10	20	30	40	50	12	10	20	30	40	50
7	10	20	30	40	50	7	10	20	30	40	50	1	10	20	30	40	50
8	10	20	30	40	50	8	10	20	30	40	50	2	10	20	30	40	50
9	10	20	30	40	50	9	10	20	30	40	50	3	10	20	30	40	50
10	10	20	30	40	50	10	10	20	30	40	50	4	10	20	30	40	50
11	10	20	30	40	50	11	10	20	X	40	50	5	10	20	30	40	50

FIG. VII.

These time cards should be marked as productive or non-productive by the foreman of the department in which the work is performed. This gives the timekeeper the information necessary to separate the productive from the non-productive labor and will be described and illustrated later.

At 6:30 A. M. a workman, Wilson, receives his time card from the clerk or foreman and is assigned to his work. At noon he has finished this work and proceeds to fill out the card. He first inserts his check number, in order that the timekeeper may identify him on the pay roll, having previously checked in at 6:30 A. M. with this number. He dates his card, signs his name, indicates what he has done, crosses 6:30 and 11:30 in the hourly divisions and hands the card to the clerk or foreman at once.

After the noon hour he receives a new card and proceeds as before. As these time cards will be coming to the timekeeper's clerk at all hours of the day from men in the department, the clerk at once inserts the price as shown by the price card (Fig. V), and computes the earnings, in this case, \$1.25.

It is of course evident that the labor performed is productive and the card is marked "Prod" meaning productive labor. Should, however, the labor be such that the clerk cannot

determine whether it is productive or non-productive he confers with the foreman. This same plan is pursued during the day and at the close of the day the clerk has all tickets computed except the last round turned in. These he computes as his first duty the next morning.

The clerk hands the day's time cards to the foreman for his approval or correction after which they are delivered to the timekeeper for the pay roll.

As all these cards are marked so as to separate the productive from the non-productive labor of the six manufacturing departments, the timekeeper is now in a position to ascertain each day or week, as may be desired, the departmental as well as the general non-productive percentage, the latter being a fixed quantity.

In computing the time as given by the time cards of a workman in any producing department, where the goods are run through in small lots, it is recommended that such a workman receive credit on his ticket for the number of pieces made at piece rate prices, and the balance necessary to make up his days wages be allowed him at his day rate and be charged as non-productive labor.

For calculating the departmental percentages of non-productive labor "labor statement" cards are provided (Fig. VIII).



The timekeeper having full information from the daily time cards received from all departments is able to divide the pay roll as shown. The total of the productive labor for the week divided into the total of non-productive labor gives the per cent of non-productive labor for the week. The "last week" item on the statement comes from a previous statement. The "to date" item includes the totals from the beginning of the fiscal year. These "to date" totals represent the amount paid in the wood shop up to and including September twenty-second, resulting in an average departmental non-productive per cent of thirty-two.

All productive or manufacturing departments are treated in the same manner, as well as the cost

LABOR STATEMENT				
WOOD SHOP		WEEK ENDING 9/22/00.		
DISTRIBUTION	PRO PIECE	PRO DAY	NON PRO	TOTAL
Pro Piece Mch.	175 20			
• Day •		12 60		
Non Pro. Pce.			175	
• Day •			72 20	
TOTALS FOR WEEK	175 20	12 60	73 95	261 75
TOTALS LAST WEEK	182 60	15 20	65 90	263 70
TOTALS TO DATE	1800 91	272 22	663 40	2736 53
DEPT NON PROD FOR WEEK			32 37%	
DEPT NON PROD FOR LAST WEEK			33 32%	
DEPT NON PROD TO DATE			32 %	

FIG. VIII.



of that part of the labor in the non-productive departments which is productive labor when expended on tools, patterns, permanent equipment, etc.

The method of obtaining the amount of general non-productive labor is as follows: If any productive labor has been performed in non-productive departments, that amount is added to the total of all productive departments. The sum of these is divided into the total of the non-productive departments after the amount of productive labor has been deducted.

From the "labor statements" of the various departments (Fig. VIII) a "labor summary" of all the departments is made up (Fig. IX).

The per cent of general non-productive labor for the current week is readily determined by dividing

LABOR SUMMARY		WEEK ENDING 9/22/00.			
DEPT'S	NAME	PRO PCE	PRO. OAT	NON PRO	TOTAL
1	Hood	175 20	12 60	73 95	261 75
2	Paint	120 60	6 19	32 70	159 49
3	Machine	229 00	18 60	80 20	327 80
4	Stitch	260 92	27 80	92 60	381 32
5	Assembly	115 82	8 96	40 24	165 02
6	Foundry	319 61	82 75	98 20	500 56
8	Shipping			75 80	75 80
9	Miscellaneous			129 50	129 50
	Total for week	1221 15	156 90	673 24	2051 29
	• Last •	1119 65	162 20	518 30	1800 15
	• to date	15892 20	1318 30	7629 35	24839 85
	Lab. Non Pro. for week			45 23	
	• Last •			40 54	
	• to date			40 12	

FIG. IX.

the amount of productive labor into that of the non-productive labor. The item "last week" came from a similar summary. The 40 per cent non-productive "to date" we apply to the total amount of labor as shown on the card (Fig. III).

The method of ascertaining and recording the proportionate cost of both the departmental and the general non-productive labor to the productive usually considered a difficult undertaking, is by this system shown to be an easy and simple computation. The purpose of these percentages is to give the absolute cost of producing each part, which is obtained by adding them to the flat cost of each part which is already established since the work is done on a piece-price basis.

WOOD SHOP				PAINT SHOP				MACHINE SHOP	
PIECE NUMBER	AMT	PIECE NO	AMT	NO PIECE	AMT	1900 DATE	CHARGES	TOTAL	
C. 1	2 35	Ford		Ford		9 21	Total Labor	16	95
C. 2	2 35					9 23	C. 4 Lues 15	16	80
C. 3	1 26								
C. 4	70								
C. 5	50								
C. 6	2 50								
C. 7	60								
C. 8	70								
C. 9	80								
C. 10	1 70								
C. 11	1 20								
C. 12	26								
C. 13	22								
C. 14	91								
Total	16 95								

FIG. X.

For convenience, these percentages are not applied direct to each part, but on assembly cards (Fig. X) on which are collected the flat cost of each part as given on the reverse of the detail cards (Fig. I reverse).

For illustration, the cost of labor in the workshop in producing of the part designated as C1 is assumed to be \$2.35.

This amount is recorded on the assembly card (Fig. X) against C1 and by the same method is charged up the flat cost of all other parts as C2, C3, etc., until all the flat labor in the wood shop is assembled, amounting in the illustration to \$16.95.

It is presumed that on September twenty-third there is a change in cost (Figs. V and VI) and it is so recorded on the assembly card (Fig. X). There being no further changes, this total, (\$16.80) as the cost of the flat labor in the wood shop is transferred to the material and labor summary card (Fig. III). After this total is also added the departmental per cent of non-productive labor for the wood shop, previously obtained (Fig. VII).

The same method is followed with the cost of all the flat or productive labor in each department until the total cost of all the productive labor in all departments is obtained together with the non-productive percentage. This total (Fig. III) is \$93.65. To this total is added the percentage of

the general non-productive labor which in this case being 40 per cent (Fig. II) is \$37.46, making the total cost of labor—productive and non-productive—\$131.11 (Fig. III).

To this is to be added the costs of material taken from the material summary cards, of which the lumber card (Fig. II) is shown. This gives a total factory cost in this case, \$228.60 for 100 8 x 20 rakes.

As total factory costs are needed but once a year, when prices are made for traveling salesmen, the total summaries (Fig. III) are made up only at or near the close of the factory year.

As by this system an accurate general average of the cost of both departmental as well as the general non-productive labor is determined, and as most manufacturers make yearly contracts for materials, it is possible to compute the cost of all material at the new prices and obtain exact costs for the ensuing season.

It is also possible at any time during a season to make a close estimate in the same way of the cost of any new article or product by taking the cost of the material, adding the known cost of the flat labor with the "to date" labor percentages in all departments which are shown by the labor statements at that time.

## MANUFACTURING EXPENSE.

---

The term "manufacturing expense" as used in these pages includes the cost of the supplies used by the factory during the year, consisting of replaced belting, emery cloth, sand paper, planer knives, buckets, brooms, mops, stationery, fuel, oil and numerous other articles of a like nature. There are, of course, many ways of accounting for these items, but their inclusion in this division accords with the working of the other departments and will be found most satisfactory.

At the time the general inventory is taken let all stock of this class be carefully listed at its asset value, deducting a certain per cent for depreciation from the value of such articles as are worn or partly used. Having done this there is now in the factory only the raw material, permanent equipment, the product in course of manufacture, and the finished goods.

At the time of commencing operations, whether at the beginning of a new business or annually after each inventory, let each foreman draw from the stock room such supplies as he needs, a proper blank being provided for the purpose. It is necessary to advise the stockkeeper as to the cost of each article in this account. This may be accomplished by a system in the purchasing department whereby invoices for all goods received pass through the stock clerk's or storekeeper's hands.

Having received and filled the order from the foreman, the material drawn is charged to the proper department on a stock card (Fig. XI). Let this card represent one article which in the illustration shows leather belting drawn for department Number One.

Have a card for each article, also a card for each department. As the usual list of supplies is not large it will not take very many cards for all of the departments. The stockkeeper should do all his posting from the foreman's orders to these cards once a day, and thus economize time.

This stock card shows the cost price and it is therefore not a difficult matter to enter the record in actual value of the supplies and not simply the quantities used. There are many ways in which the ledger can be divided, but it is recommended

that there be used a card having a guide projection in the center and extending one third of its length, for the division of the different kinds of stock, and a card with a tab (Fig. XI) for each department.

As these tabs indicate the numbers of the department it is easy for the stockkeeper to locate any cards wanted when posting.

The system, once started, requires but little labor to keep up, and as a replacement is infrequent, the expense is small. If desired, the capacity of the cabinet may be enlarged and used also to keep a record of all material in the stock room, although for cost purposes it is not necessary.

The superintendent and the manager as well,

[illegible]

FIG. XI.



will also find that a weekly report or manufacturing expense summary (Fig. XII), made up from the stock cards (Fig. XI), is very helpful in eliminating unnecessary expense in any department. This report, either on a card or on a sheet, may accompany the reports of labor in the various departments (Fig. VIII). These two reports show the actual cost of the labor performed and of the supplies consumed for the week, which may be discussed and analyzed with the foremen.

This weekly report of manufacturing expense also serves as a basis for applying this expense to labor cost, either at the end of the season, or at any time during the season, when the factory costs of making any new articles of manufacture are under consideration.

MANUFACTURING EXPENSE SUMMARY											
WEEK ENDING											Sept. 22-00.
DEPARTMENTS											
MATERIAL	1	2	3	4	5	6	7	8	9	10	11
Belling	2.70										
Emery Wheels	9.60										
Pills	2.60										
Turnst Drills	1.20										
Brooms	.50										
Etc.											
Etc.											
Etc.											
Etc.											
Weekly Total	16.60										
Last Week	15.20										
To Date	22.90										

FIG. XII.



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In pro-rating this expense over the cost of the given article, it is recommended that the entire output of the factory be computed at prices derived from the cost estimates, and that this amount be divided into the total cost of the supplies used. This gives the per cent which is added to the labor and material cost of the individual article to secure the net factory cost.

Of course this per cent during the season could not be readily arrived at owing to the unfilled orders in the factory, but the total cost of supplies for years previous is known, and a per cent based upon this would answer for the special costs necessary to be estimated during the season.

If in calculating costs at the end of a season for the succeeding season it should be found that the proportion of supplies used is 10 per cent of the entire cost of the product, and the article in question costs \$10.00, the manufacturing expense would of course be \$1.00 for each article, which would be added to the factory cost.

## GENERAL EXPENSE.

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General expense in connection with a cost system is to many managers a source of annoyance, and how to ascertain the proper percentage to be applied to the factory cost is a problem which is ever before him. Again, how to apply the anticipated profits has been a much discussed question with all.

While it is not claimed that this method of treating general expense will satisfy every manufacturer, yet he will be convinced that if he will apply the items that go to make up general expense as here indicated, the estimated cost will vary but little, if any, from the actual costs.

The term, general expense, as here used includes such items as salaries, traveling expenses, taxes, insurance, uncollectible debts and notes, depreciation of product as well as of manufacturing plant, freights, telephone rent and telegrams,

express charges, advertising and similar items of a miscellaneous nature.

There are two ways in which general expense can be arrived at for cost purposes. Either is sufficiently accurate to obtain satisfactory results, one having the advantage of being short in application while the other is somewhat more difficult and tedious.

The simplest method is to keep a close account of all items entering into the general expense account as direct charges, and ascertain the total of this account for the year, adding a suitable allowance for uncollectible accounts, depreciation of product, plant, etc.

Divide this total by the total cost of the entire output less the value of material on hand as shown by the inventory. This result will be the per cent which is to be added to the cost estimate.

It is suggested that the salaries of traveling men and their expenses be kept separate and by districts or territories. This will make it possible to ascertain the cost per cent of selling in each district.

This separation is recommended as many manufacturers well know that their selling expense in one territory is much greater than it is in others. This condition alone often prevents a concern from doing a profitable business in certain localities which disadvantage would be removed by

making each locality stand its own share of the selling expense, instead of pro-rating the entire selling expense over the entire product.

In the handling of a certain product one territory is known in which it costs 40 per cent of the selling price to market the goods, whereas in others it requires only from 3 to 5 per cent. If a district selling expense account is kept an expensive territory can be quickly located and abandoned, if the resulting profit is not worth the time and expense required to secure the business. If the selling expense account is not divided in this manner these facts are lost sight of. It can be done either by the ledger accounts or by a simple ruled distribution book or card file which the bookkeeper can keep without difficulty. If the latter is used there is a card for traveling expense, for salary, and for any other incidental expense of the salesman in each district.

On the reverse side may be kept a daily, weekly or monthly record of the sales. At the end of the year a few simple computations only are necessary to arrive at the desired results.

The other plan of ascertaining the per cent of general expense to be added to the cost estimates, of which mention was made, would be carried out in the main in the manner just described, except that instead of waiting until the end of the season to

apportion the monthly fixed expense, reserve and suspense accounts are opened in the ledger to cover such items of expense as are not directly incurred during the month in review.

In reserve accounts are included such expenses as cannot yet be exactly determined and whose payment therefore must be deferred, for illustration, taxes. To this tax reserve account would be credited the estimated amount of the yearly tax, the same amount being charged to an Accruing Tax account. This amount would be pro-rated monthly into the general expense account and the pro-rated sums credited to Accruing Taxes. At the end of the year, if the estimate was correct, the cash payment should close the Tax Reserve account and the pro-rated sums which have been credited monthly would close the Accruing Tax account. Other reserve accounts are handled in the same way.

Suspense accounts which comprehend expense paid in advance for terms longer than a single month are handled in the same manner except that the suspense account would be charged with the money paid and the amount pro-rated to general expense according to the number of months covered by the payments. For instance if insurance premiums are paid six months in advance, one-sixth would be charged out each month so

that at the end of six months general expense would have consumed all of this amount and the Advance Insurance Premium account to which is charged the cash payment, would be closed. Salesmen's expenses and other similar items are handled in the same manner.

The difference in the two methods is the difference between general expense known only at the end of the year and a definite statement of all general expense items for each month. The first is simple and for yearly cost purposes is generally satisfactory, while the second method is equally good for yearly costs but also gives a monthly general expense statement which for many reasons is preferable.

Either method can be used with a card system, thus reducing the cost of maintenance, or can be kept in the ordinary ledger.

## SPECIAL COSTS.

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Special Costs is a term used to include the extra items of cost arising from defective manufacture, the substitution of expensive material, such as brass in place of malleable iron, and such items as may result from oversight on the part of some foreman or other employe, or from a failure of prompt delivery of material.

If these expenses cannot be traced directly to some source against which they may be charged, they should be borne by the specific part of the product affected and not charged over the entire product or to the general expense account.

It is suggested that a Special Cost account be opened in the ledger, covering such items and that this account carry this expense throughout the season regarding it as an uncollectible account which is to be pro-rated over the cost of the product affected.

The natural inquiry is, why should this expense, incurred during the previous year, be added to the cost of the goods to be made the following season? The reason is, if a certain amount is charged up during one season for oversight and errors, there is a strong probability that similar conditions will continue to exist, and an allowance should be made, as it would be for bad debts, interest on the investment, etc. This separate account gives facts to work on, while if the items were merged in the general material accounts they would be lost sight of entirely.



## PROFITS.

---

To the cost estimates with all percentages included must now be added a certain per cent for profit. For example, assume twenty per cent as the desired profit, and \$10.00 as the cost of producing an article in the factory, ten per cent as the per cent of manufacturing expense, fifteen per cent as the per cent of general expense, and five per cent as the per cent of selling cost, then \$13.00 is the total cost of the article. If twenty per cent be added to this the selling price is \$15.60 in the territory costing five per cent to sell in. This will assure you a profit of about twenty per cent on the money invested for the machine.

Now, let us consider the different cards and blanks and see how each may be elaborated to make a broader, but perhaps more complicated system.

The detail card (Fig. 1 reverse) may be changed

so as to provide a column for recording the price as well as the quantity of the stock with one or two additional columns for changes in price. This card then becomes a working price sheet, and when the non-productive labor percentages are added to these prices a cost record of pieces or parts is attained which furnishes a cost basis for prices of repair parts as well as for the inventory. As these cards are kept up they furnish a permanent corrected record of cost prices for these purposes at any time they may be desired.

In making these computations for inventory purposes it is not recommended that the percentages for manufacturing and general expense be added. Annual inventory prices should not be inflated and for this reason factory cost prices only should be used

There is always a certain amount of stock taken into the inventory which is valued at the original cost while it has really depreciated. Taking the inventory at corrected cost prices will therefore, in a measure, correct these errors.

The material summary card (Fig. II) shows in this instance the total cost of lumber used in the 8 x 20 rake. From these material summary cards a computation may be made, showing the approximate number of feet of lumber required for each size and kind of machine made, thereby giving

the required unit necessary for a given number of machines of each class. Further computations may be added, giving the total costs as shown by the cards. These furnish valuable data in estimating the requirements for the next season.

Further, if the cost of the labor on each kind of article as shown on the total summary cards (Fig. III) is summarized, a very close estimate will be attained of the amount of money required for next season's labor.

These cards (Fig. III) may be so modified that manufacturing and general expense are included with the factory costs. If this is done nothing need be added to make the record complete but the selling price and the profit wanted. A column may be added in which to show the total feet of lumber, or the weight of the material.

By completing the records in this way it is easy to make comparative yearly statements of the cost of material and labor and the percentages of expense and profit.

When the information on the cupola record (Fig. IV) is complete there is still ample space for other information for the superintendent. For example, if it is desired to know the average cost of molding, add to the total productive labor in the foundry, the total non-productive per cent, which in this case is (40); divide this amount by

The piece price card (Fig. V) may be ruled on the back in such a manner as to provide space for a record of orders received and parts made, taking the place of a department order book. This is particularly advantageous for the foundry and steel shops.

If the cards (Fig. V), are of good material the items may be recorded in pencil, and at the end of the season this record may be erased and the cards used again.

[illegible]

FIG. XIII.

While the timecard (Fig. VII) is intended for the guidance of the timekeeper in making up the pay roll, it may be passed to the cost department and the labor recorded thereon entered on a piece-work record card (Fig. XIII). This card shows the number of each piece made, at what time, by whom, the number of hours necessary in making, the total amount paid and the average rate per hour earned by each workman.

This is useful information and is well worth the time and effort necessary to keep it in proper order, as it indicates whether the scale of piece prices paid is profitable or whether it should be revised. Then, too, the same cards may be used as a basis for opening a ledger account with each lot of goods going through the factory. To each account is charged all the labor and the material consumed in the process of manufacture and the cost of the yearly production of any particular lot is shown, no matter when it was made.

By using order numbers in the factory for each lot of goods going through at one time, practically the same form of cards could be used by simply adding a place for the order number and charging the cost of labor to that number as well as the cost of all material drawn on requisitions correspondingly numbered. By this method the exact cost of the lot is obtained.

This, however, is bringing the system nearer and nearer to a balance ledger cost system and therefore becomes more expensive and complicated.

The labor statement cards (VIII) may be provided with columns other than those shown in the illustration, in which the manufacturing expense may be recorded, as on the manufacturing expense summary cards (Fig. XII).

This places before the foreman of the department the exact expense incurred by his department during the week from which report he may intelligently discuss with the superintendent the conditions in the factory, particularly in his own department.

Through these statements unnecessary items of expense are often discovered which can be eliminated, thus adding to the net profit.

Again, a column may be added in which the time-keeper may compute the per cent of piece work to day work, another column to show the number of men employed in the department and the average wage rate paid per hour. A total summary of all this information may be made on the labor summary cards (Fig. IX) covering all departments.

To this system for ascertaining factory costs may be added a system of inventories on cards which will show the number of pieces made and

in stock, and their location in the stock or store room. The operation of such a system is considered more fully in the chapter on perpetual inventories but the procedure in general is as follows:

When a lot or run of parts or pieces is started through the factory, it should be accompanied through all the various departments by a tag board slip indicating the department which it is to reach finally, the number of pieces sent, the piece name or number, and any other information that may be necessary. This card should accompany the lot until it is put in stock or storage.

The assembly room should draw on this stock by requisition only. Then a record of finished parts in stock is easily maintained and the requisitions themselves show the quantities in the assembly room being placed in finished product.

The finished goods sent to the warehouse from the assembly room should be accompanied by transfer slips showing the exact number sent. The clerk in charge of the inventory cards, having received properly signed requisitions for the finished parts, makes the necessary changes on the records.

Such a system provides a simple record of all parts made and on hand, and if shipments are checked against the goods in the warehouse a

complete inventory results. Further, by using the record of costs as shown by the detail cards (Fig. I) an accurate inventory with values can be compiled at any time.



## PERPETUAL INVENTORIES.

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Perpetual inventories with cost values attached are not as a rule successful. There are many reasons for this lack of success, but the principal ones are those that arise from lack of systematic methods and the inattention of those directly connected with the operation of the system.

To operate a system of this kind successfully means careful attention on the part of those in charge of the work and the close supervision of employes. With some manufacturers the detail is so great as to make the maintenance of such a system impractical. In concerns manufacturing or handling thousands of different parts or articles, the system means additional labor and expense, and in some cases, a curtailment of the out-put. But in the average factory it is effective and thoroughly practical.

Perpetual inventories are of two kinds. One

includes the cost prices of the goods; the other simply a quantity record of the parts or articles in course of manufacture and in stock.

A combined perpetual cost and stock record is too complicated for the ordinary manufacturer to keep accurately. It means a vast amount of labor from which there is no apparent benefit.

The system we shall now describe, therefore, embraces simply records in quantities. Its maintenance means but little extra labor. It is so exceedingly simple in the mere recording of the movements of parts and pieces that errors are not likely to occur.

The first need is for a clerk thoroughly familiar with all the details of the factory. It is essential that this clerk can be depended upon for accuracy.

For his records there should be provided cards of sufficient size and number so that each piece shall have an individual card. These cards are filed in the drawers of ordinary card cabinets.

For the stock there should be properly arranged bins, shelves, etc., for storage, and the storage room should be conveniently located to the assembling department. It should be in charge of a careful stockkeeper.

In some factories the storage compartments are scattered about the different departments and the foreman of each department has charge of the

stock. This plan is ordinarily not satisfactory. It is best to have the stock concentrated and in charge of one man.

Workmen, particularly piece workers, are apt to avoid rules and consequent delays, and take out stock without proper orders. This means a confusion of records and the defeat of an accurate inventory.

In describing this system it is assumed that the factory is divided into six departments: blacksmithing, foundry, machine, wood, assembling and painting or finishing. It is, of course, equally applicable to a factory with departments lesser, or even greater in number.

In the blacksmithing department steel and iron

REQUISITION FOR STOCK						
<i>Williams</i>		FOREMAN		DATE <i>Jan. 16</i> 190 <i>1</i>		
QUANTITY	DESCRIPTION	WEIGHT OR FEET	PRICE	DEDUCT FROM		
				BIN	SHELF	SECTION
<i>2</i>	<i>Bar 3/8" x 1" Com. Steel</i>	<i>30</i>	<i>1.35</i>	<i>2</i>		<i>1</i>
	<i>for side brace on vob</i>					
	<i>Wagons # 16</i>					
DEPT NO. <i>1. Steel Works</i> <i>Jenkins</i> FOREMAN						

FIG. XIV.



When the materials withdrawn from stock by these requisitions enter the process of manufacture, they become a part of the inventory of pieces and parts. To keep these conveniently, cards (Fig. XVI) are provided which are in a card cabinet kept in the blacksmithing department.

When an order for any part is started in the shop a card is made out with the name of the part, its numerical or catalog number, and the article or machine upon which it belongs. In the proper columns are inserted the date and the number to be made. In the column headed with name of the first operation to be made, the num-

[illegible]

FIG. XVI.

ber on which work is begun is entered and an order given to the workman.

As shown by the card there are other operations to perform before the work to be done in this department is finished. To obtain a record of these operations it is necessary that the workmen specify on their time cards the number of pieces made, and the operations they were performing. Every morning the clerk or foreman when checking the time records on the cards (Fig. XVI) indicates the operations performed on the different pieces. These entries make a complete record showing each day the exact condition of the parts in course of manufacture.

When finished the parts are sent to the next

TRANSFER SLIP		DATE
FROM DEPT.	<i>Steel Works</i>	<i>Jan. 18, 1901</i>
TO DEPT.	<i>Machine</i>	
NO. OF PIECES	<i>30</i>	PIECE NO. <i>2116</i>
MACHINE USED	<i>ON NO. 300 Wagon</i>	NAME <i>Side Base</i>
REMARKS		
		<i>Jamison</i> FOREMAN
STORAGE RECORD		
IN	OUT	
SECTION <i>2</i>	SECTION	
BIN	BIN	
BACK <i>41</i>	BACK	
SHELF	SHELF	

FIG. XVII.

---

department accompanied by a transfer slip (Fig. XVII) made in duplicate, showing where the parts are to go. From the duplicates of these transfer slips the clerk or foreman posts each morning to the cards the number of parts finished and sent to other parts of the factory.

Most parts go from the blacksmithing or steel department to the machine department for further operations. In this department should be another card cabinet with cards substantially like those used in the blacksmithing department (Fig. XVI), the operations, of course, being changed to conform with the work of the machine department.

When parts reach this department they are checked with the transfer slip (Fig. XVII) and their disposal arranged for by the foreman. From the transfer slips entries are made on the cards (Fig. XVI) to show the number received.

The operations as performed are posted from the time cards and when finished the parts are sent to storage accompanied by transfer slips (Fig. XVII) made in duplicate. From these duplicates entries are made on the cards (Fig. XVI) showing the delivery of the parts.

The store-keeper receives the parts and indicates in proper spaces provided on the original transfer slips, the places where the parts are stored. Every morning the slips are forwarded to the in-



ventory clerk who makes the proper entries on the cards (Fig. XV) to show the quantity of these parts that have been put in storage.

In other departments the stock is handled in substantially the same manner. In the wood shop it is possible to handle lumber in store or pile the same as iron or steel, but it is recommended that the lumber inventory be kept according to the number of feet in each row of the lumber piles. This is sufficiently accurate for all purposes.

In withdrawing lumber from the piles for use, it should, of course, be estimated on the same basis. As with all other material it should only be drawn on requisition (Fig. XIV).

GOODS RECEIVED SLIP				
FROM <u>James T. Laughlin</u>		DATE <u>Jan'y 18, 1901</u>		
<u>Pittsburg, Pa.</u>				
REC'D BY <u>Conwell</u>	CHECKED BY <u>Conwell</u>	GRAY MESSENGER	RAILROAD	
OPENED BY <u>"</u>	ENTERED BY <u>Baker</u>	<u>Penn.</u>		
QUANTITY	ARTICLE		PRICE	STORAGE
10000	$\frac{1}{2} \times 2\frac{1}{2}$	Comm. steel	1.45	Sept 1-
5000	$\frac{3}{4} \times 1\frac{1}{2}$	" "	"	"
2000	$\frac{1}{4} \times 1\frac{1}{2}$	" "	"	"
10000	$1\frac{1}{4}$ Round	Eld. Rolled cut 12'	1.85	Sept 2
3000	1"	" " " 7'	"	" "
REMARKS <u>Penn. Co. bear 18921</u> <u>bold. Rolled slightly rusted</u>			<u>Hillard</u> RECEIVING CLERK	

FIG. XVIII.



When stock or goods are received, "goods received" slips (Fig. XVIII) are made in duplicate by the receiving clerk. Both, originals and duplicates, are sent to the inventory clerk who retains the duplicate and sends the original to the purchasing department that they may check the invoice.

The foundry department will handle pig iron, coke, sand and other material on requisitions (Fig. XIV) just as steel and other material is handled in other departments. The foundry would also make out transfer slips (Fig. XVII) for all good castings sent to the factory.

Both in the wood shop and in the foundry there should be card cabinets and cards for a record of the parts made (Fig. XVI). These cards with changes in the operations are the same as those used in the blacksmithing and in the other departments.

The foundry has, of course, but two operations, molding, and cleaning or rattling. It is advisable that the transfer slips are not made out until after the castings have been rattled, for then the slips indicate the number of good castings only.

It is in the assembling and painting or finishing departments that the most difficulty is met with in maintaining a perpetual inventory. Before installing the system in these departments the



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compilation of detail or specification lists will simplify the work.

For each article of manufacture a complete detail or list of parts making up the article should be made out. If more than one article is packed in a bundle or case, make note of this.

When the assembly room requires parts from stock the clerk or foreman should make out an assembly room stock slip (Fig. XIX) and send it to the stock-keeper for the goods or parts wanted.

These slips (Fig. XIX) are used in a similar way to the requisitions and save all unnecessary clerical work in the assembly room. The store-keeper forwards them each day to the inventory clerk.

When the assembling department has bundles, cases, or parts to send to the painting department, transfer slips (Fig. XVII) are made out just the same as in the other departments. These slips are retained in the painting department until the goods are ready for the warehouse when they accompany the goods finished. The warehouse men will note the place of storage on the transfer slips (Fig. XVII) and send them to the inventory clerk.

The painting department should draw all materials on requisition the same as any of the other departments. While there is no objection to keeping an individual record either in the paint-

ing or assembling departments, it is only added labor, for the goods there are so near completion that the inventory clerk's record will always be available and nearly up-to-date. All goods in the assembling and painting or finishing departments must be accounted for at the close of the season or the inventory will not be complete.

When the defective goods are returned to the factory they are usually taken apart and the good parts refinished and put in stock again. The clerk whose duty it is to receive these goods should make out "goods received" slips (Fig. XVIII) showing to what departments they are sent for separation.

The department separating returned goods sends the parts to other departments on transfer slips (Fig. XVII) and also makes slips for those returned. This method starts the parts through the factory again as new pieces.

Such goods as it may be best to keep in the storeroom, including files, twist drills, emery wheels, bolts, nuts and washers, belting and similar material, can be accounted for by using "goods received" slips (Fig. XVIII) for goods received, and requisitions (Fig. XIV) for goods used. Both of these slips go to the inventory clerk.

If a separate record of such material is desired for the stock room itself, a separate cabinet fitted

with cards (Fig. XV) may be kept and thus relieve the inventory clerk. These cards may be ruled to include the prices paid for supplies bought outside the factory and stored in the stock room.

Such a record will be of material assistance in making up the inventory at the close of the season. It will save that time of the purchasing department usually spent in searching for invoices. These prices may also be entered on the duplicate "goods received" slips.

In a large factory one or two extra inventory clerks should be at work constantly verifying the inventory. All parts and pieces in stock should be checked up that the inventory may be accurate. As a result of this accuracy the annual "shut-down" and consequent loss of factory organization is avoided. The factory may be operated continuously barring accidents and unavoidable repairs, and an inventory complete and accurate may be made on any day desired. The cards are always within one day of the factory operations.

The prices to apply to parts on hand can be secured from your cost records.

While this system of perpetual inventory is not necessarily a part of the cost system explained in the preceding chapters of this book, the two systems work well together.

Changes may be made on the different forms to broaden their application and to apply the system more closely to the particular requirements of any factory. Such changes will occur to the user from time to time after the system has been put in actual operation.

On the back of the requisition (Fig. XIV) may be printed a convenient form of shop order. When the foreman wishes to give the employe a piece of work he fills out the order side of the sheet specifying the size of stock and what it is for. He also makes out the requisition on the front of the slip and hands the card to the workman. The stock-keeper after issuing the stock notes on the card the proper weight and the workman proceeds according to the instructions on the order.

When the workman has completed the work called for on the order, it is returned to the foreman and serves several purposes. It is a foreman's order and also a requisition for stock. It tells the foreman that the work ordered is completed and it serves as a record not only in the one department but for the inventory clerk as well.

The backs of the cards (Fig. XVI) may be used as a record of the piece rate prices paid for different operations. It makes an admirable operation sheet and the foreman or clerk can use the infor-

mation in computing prices to be paid for the work performed as shown on the time card (Fig. XVI).

If these price records be kept on the backs of the cards (Fig. XVI) a total cost of operations may be easily computed and by adding the proper percentages of expense a close estimate of the cost of any parts in any stage of manufacture can easily be made. This convenience will be greatly appreciated when compiling inventory values.

Other forms of time cards may be used, but this one (Fig. XX) is recommended for its simplicity. The workman has no writing to do, but simply indicates the time with crosses.

Three of the forms illustrated (Fig's XVII, XVIII and XIX) are for specific purposes and admit of but few if any changes.

WORKMAN		TIME CARD		CHECK NO. 20	
<i>J. J. Russell</i>		DATE <i>Jan. 17</i>		190 <i>1</i>	
<i>Cutting 30 21.16 @ 1/2</i>				<i>15</i>	
<i>Punching 30 . . . . . 1.5</i>				<i>30</i>	
MORNING					
START			STOP		
6	10 20 30 40 50	6	10 20 30 40 50	12	10 20 30 40 50
7	10 20 30 40 50	7	10 20 30 40 50	1	10 20 30 40 50
8	10 20 30 40 50	8	10 20 30 40 50	2	10 20 30 40 50
9	10 20 30 40 50	9	10 20 30 40 50	3	10 20 30 40 50
10	10 20 30 40 50	10	10 20 30 40 50	4	10 20 30 40 50
11	10 20 30 40 50	11	10 20 30 40 50	5	10 20 30 40 50
AFTERNOON					
START			STOP		
12	10 20 30 40 50	12	10 20 30 40 50	1	10 20 30 40 50
1	10 20 30 40 50	2	10 20 30 40 50	3	10 20 30 40 50
2	10 20 30 40 50	3	10 20 30 40 50	4	10 20 30 40 50
3	10 20 30 40 50	4	10 20 30 40 50	5	10 20 30 40 50
4	10 20 30 40 50	5	10 20 30 40 50		

FIG. XX.

None of the other forms are arbitrary, but may be changed in any way to more closely cover the requirements of any factory in which the system is introduced. But, when first introducing the system it is advisable that as few changes be made as possible.



WHEN WRITING THE DEPARTMENT MENTION THE NUMBER OF THIS CERTIFICATE

CONSULTATION CERTIFICATE 3391

**SHAW-WALKER**

MUSKEGON MICHIGAN CHICAGO

This certificate entitles the holder to the advice of any or all of the experts in the

**DEPARTMENT OF EXPERT SERVICE**

Such help comprehends not alone mere suggestions for needed systems but complete drawings and working plans

None of the other forms are arbitrary, but may be changed in any way to more closely cover the requirements of any factory in which the system is introduced. But, when first introducing the system it is advisable that as few changes be made as possible.

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**T E S T I M O N I A L**

Dr. I. Kltsee, Philadelphia, Pa., the well-known Electrical Expert, Analytical Chemist and Inventor, who alone has filed more than one hundred and fifty applications for patents, says:

"Mr. Cromwell has been retained by me for a long time as my attorney and counsellor in patent causes. His work has always been of the highest order, and he has been eminently successful in all my matters."



# Night Work

if continued to any great extent, will surely react both on the condition of mind and body. A man working hard all day should be able to leave his work at the office and spend the evening hours with his family. His constitution requires rest and recreation.

**Every employer** should look into the details of his business and see if there is not a vast amount of wasted energy in the administration.

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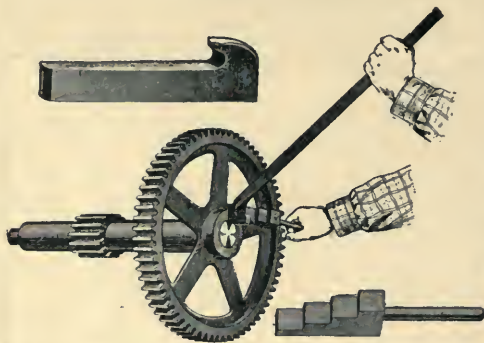
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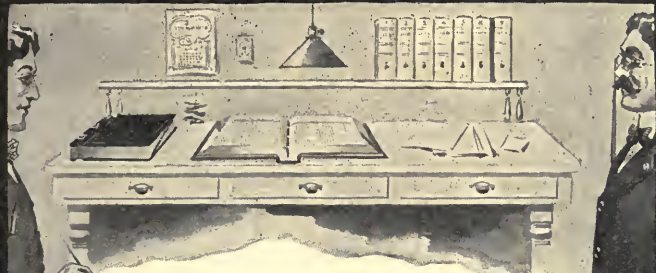


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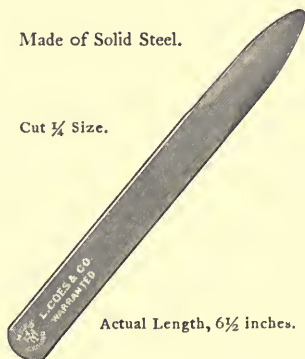
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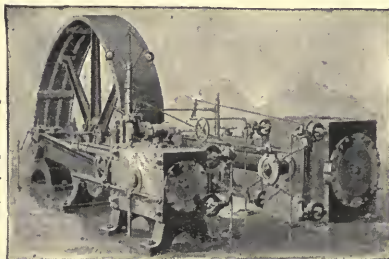


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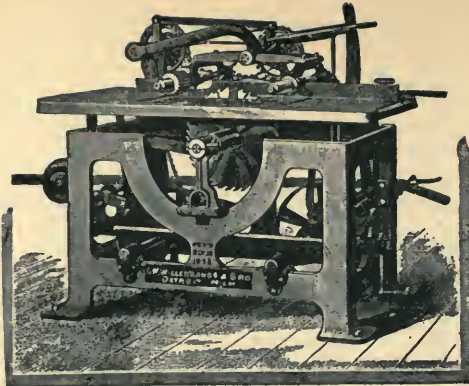
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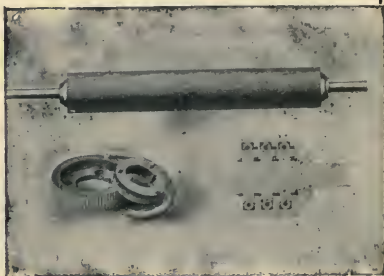
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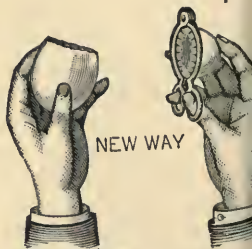
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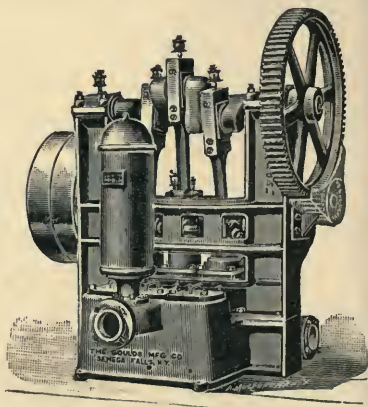
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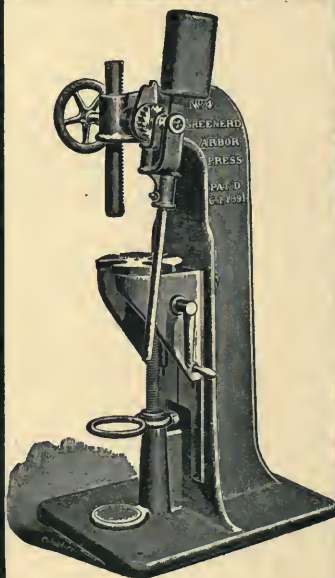
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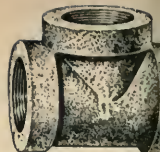
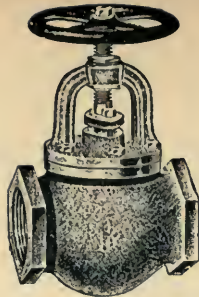
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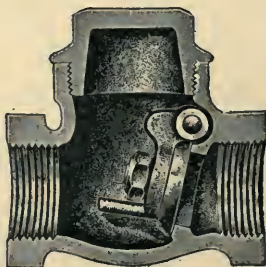
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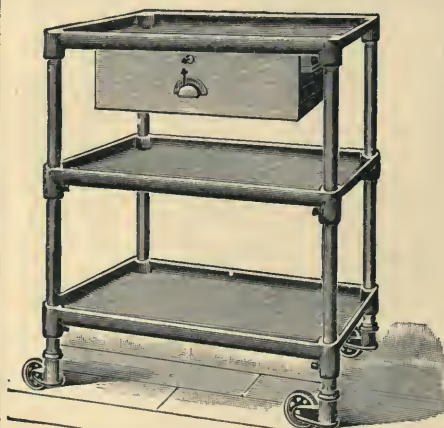
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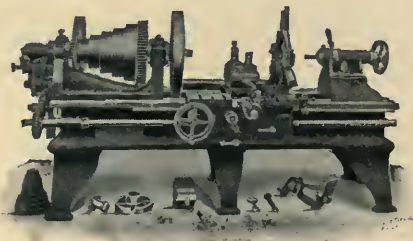
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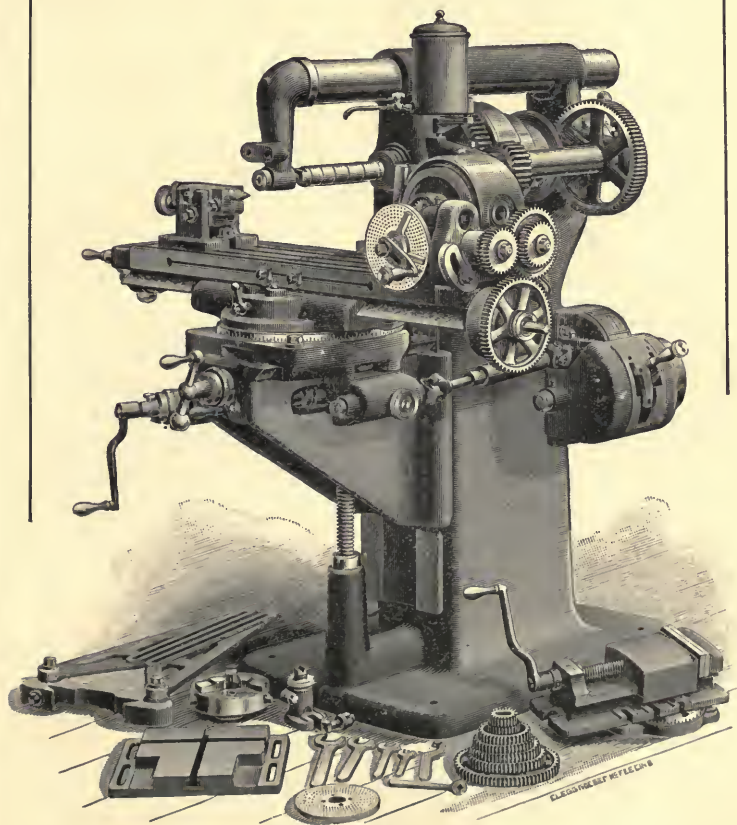
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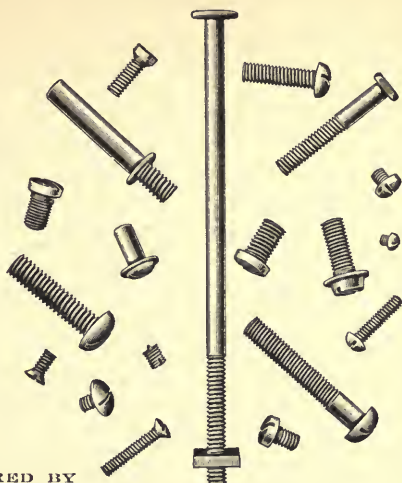
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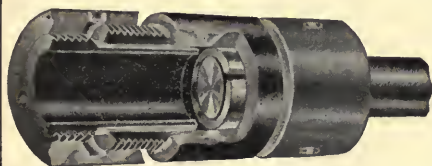
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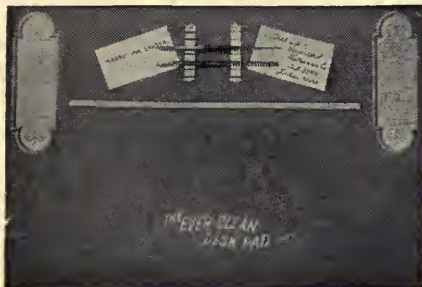
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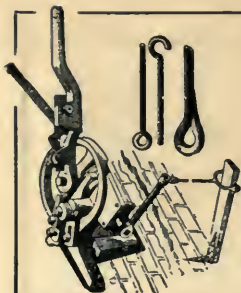
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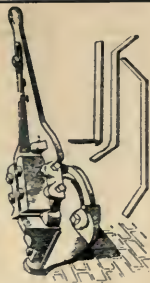


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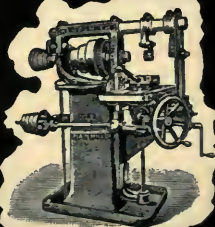
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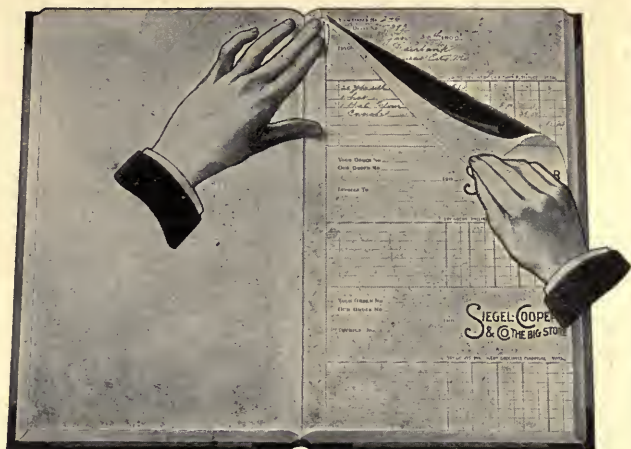
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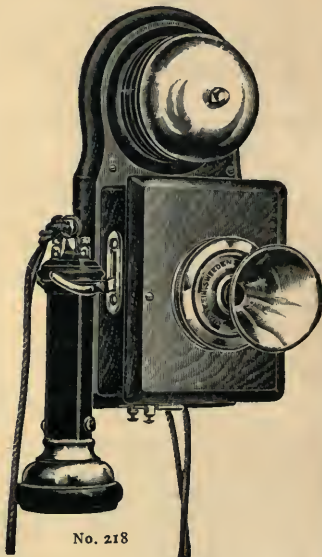


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